

# Independent Review of F114 and F102 Calibration Facility and Operations

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## **J.L. Shepherd gamma irradiator**

Observation: NIST traceability is maintained via a periodic recalibration of the facility. This has recently been performed at approximately 2 year intervals. All instrumentation used in the calibration of the Shepherd irradiator range was calibrated prior to the range calibration. The X-radin ion chamber set and Standard Imaging electrometer was calibrated by the UWADCL (NIST 2ndary lab). The Fischer barometer/thermometer set was recently purchased and has a calibration from the supplier.

Comment: ANSI N323 has stated an annual facility calibration.

Obervation: Extra shielding has been added around the Shepherd irradiator in the form of stacked Pb bricks to reduce the background radiation.

Comment: The Pb bricks are neither restrained nor covered. As the irradiator is several feet off the floor, a falling brick could cause considerable personal injury. Uncovered lead also is a potential toxic hazard. Covering and restraining the bricks is recommended.

Observation: The J.L. Shepherd source is the only gamma calibration source used for instrument calibration. It is used with a large selection of attenuators to obtain the desired exposure rates from near background levels to approximately 80 R/hr.

Comment: The Shepherd source is not large enough to properly cover the highest ranges of all instruments (specifically the Ludlum 'Stretch Scope'). A larger source should be obtained to cover all ranges.

Comment: The attenuators provide a softened spectrum which can result in response differences between instrument types. The use of attenuators is an obvious cost issue, but should be avoided if possible with future source acquisitions.

Observation: The Shepherd source exposure rate table is referenced to distance settings. That is, the table is set up for specific whole number distances eg. 100, 120, 150cm, etc. The exposure rates with the various attenuators are stated for each distance. Obtaining a specific exposure rate, eg. 100mR/hr, is not possible using this method. The operational reasons for this method are understood. Adjustment of the range distance is difficult, so minimal adjustments are desired between measurements. One distance is set and the attenuators are used to obtain various exposure rates at the set distance.

Comment: Future source calibration ranges should incorporate an easily set distance positioner and utilize a more conventional calibration table referenced to exposure rate.

Observation: RWP 2009-202-0001 states the background levels in the F114 facility as 5mR/hr @ 30cm. from the Shepherd irradiator and 9mrem/hr @ 30cm. from the neutron source when both sources are in their 'storage' positions. This presents problems with calibration of low level instruments with the background levels this high.

Comment: The future use of F101 room as an additional calibration facility was discussed. Separating the high level and low level calibration would be quite desirable to allow better low level calibrations.

Observation: Facility characterization and documentation.

Comment: The Shepherd range has been characterized for scatter and a descriptive document prepared. Cross-sectional studies have been completed at several distances. Further studies are in progress.

## **Neutron Source Operations**

Observation: The AmBe neutron source (FIA Calibrator) is approximately  $1 \times 10^8$  neutrons/sec. It is manually (remotely?) extracted from the shield and moved into position with the use of a garage door opener system. A capture device positions the source for irradiation at the downstream end of the gamma calibration track. The calibration room has a concrete floor and walls which enhance neutron scatter.

Comment: If possible, neutron irradiations should be performed in a more 'open' area. This is not always economically feasible, so room return measurements are necessary to compensate.

Comment: The neutron facility has been well characterized and documented to include measurements of room return.

## **Facility Interlock**

Observation: A facility interlock is provided which drops the Shepherd gamma source into its shielded position and causes an alarm to sound. During a neutron irradiation, only the alarm occurs. The neutron source remains in position.

Comment: It is preferable that the neutron source be moved back to its shield if an interlock trip occurs. This would not occur instantaneously but will provide a greater distance and thus lower

accidental dose. An automatic method to place the neutron source back in the shield should be investigated.

Comment: Documented tests of the interlock system are performed on a routine basis.

### **General Facility Documentation**

Observation: Procedures and RWPs cover all aspects of facility operation.

Comment: Well covered.

### **Wipe Surveys**

Observation: Wipe surveys of technicians work areas are performed on semi-annual basis.

Comment: Recommend more frequent wipe surveys as a leaky source could cause extensive problems.

### **Inter-Comparison Calibrations**

Observation: Laboratory inter-comparison calibrations are recommended as a 'best management practice'.

Comment: This can be easily done, on an annual basis, between ANL and Fermilab as we are physically close. This can be as simple as a single instrument exchange from each laboratory with a request for a check at one exposure rate.

### **Visitor Access to F114**

Observation: Difficulty in obtaining visitor permission to enter the F114 facility. This was due to a single person authorized to perform the required radiation survey. That person was on vacation.

Comment: An authorized backup person should be available.